Chemistry In Everyday – life

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Drug

- Drug is defined as a chemical substance which is used for the purpose of diagnosis , prevention, cure or relief from disease .

Classification

Classification of drugs

- **1.Based on pharmacological effect**:

Analgesics : pain killers

Antibiotics and antiseptics : arrest growth or kill bacteria.

2.Based on action of drugs :

- They have different biological mode of action
- E.g. painkillers , arthritis

Classification of drugs

- **3.Chemical structure**

  E.g. sulphomides :antibacterial activity .

- **4.Molecular targets** : interact with biomolecules .

Cabohydrates, proteins, lipids, nucleic acids

- **5. Lay public** : analgesics , cough syrups and

Interaction of drugs

- Drugs interact with biomolecules present in the cell .The macro – molecules like proteins perform various functions in the body :

- 1. biological catalyst – enzyme
- 2.Communication – receptors
- 3.carry molecules across the cell membranes :carrier proteins .
- 4. Nucleic acids – coded genetic information

(a) Catalytic action of enzymes

- The first function of an enzyme is to hold the substrate for a chemical reaction.

- Active sites of enzymes hold the substrate molecule in a suitable position, so that it can be attacked by the reagent effectively.

Substrates bind to the active site of the enzyme through a variety of interactions such

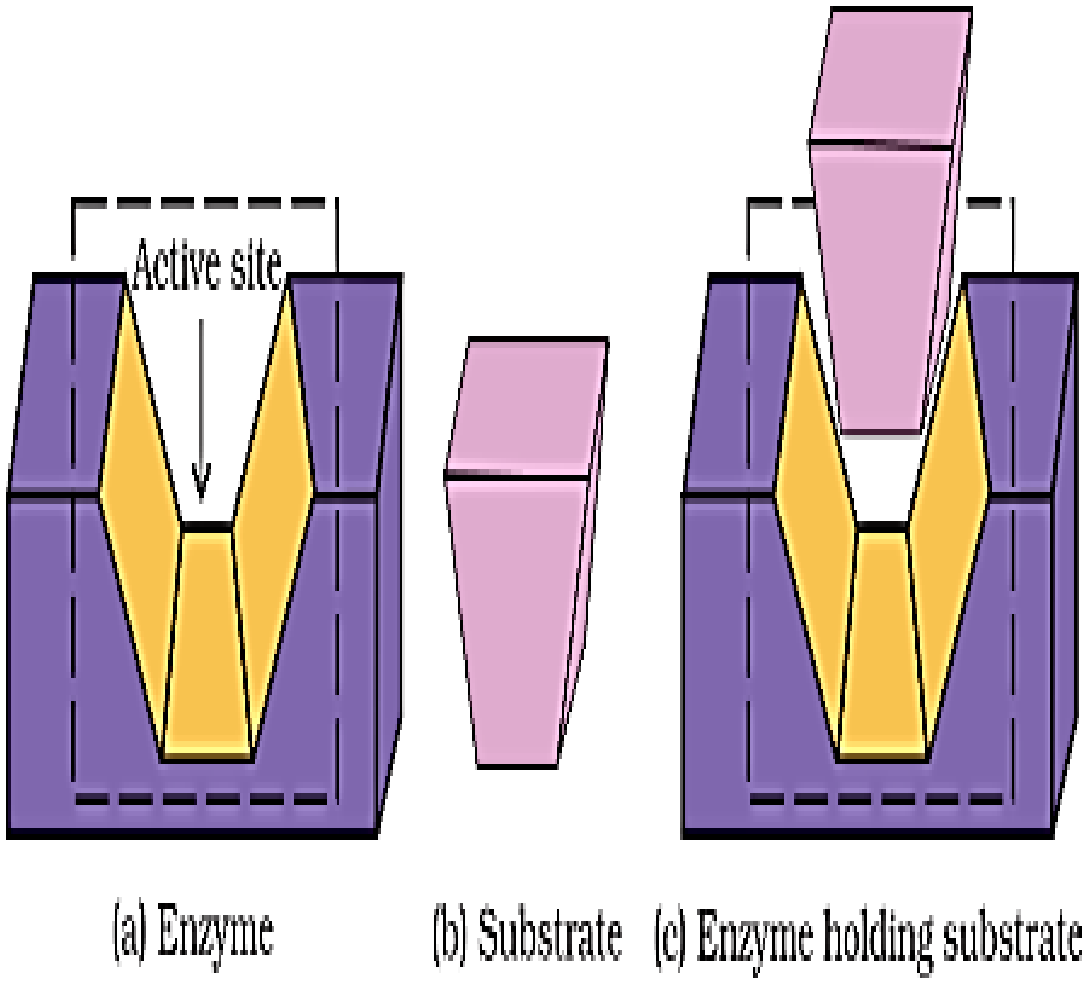


Fig. 16.1
(a) Active site of an enzyme (b) Substrate (c) Substrate held in active site of the enzyme

(b) Drug-enzyme interaction

Drugs inhibit any of the above mentioned activities of enzymes.

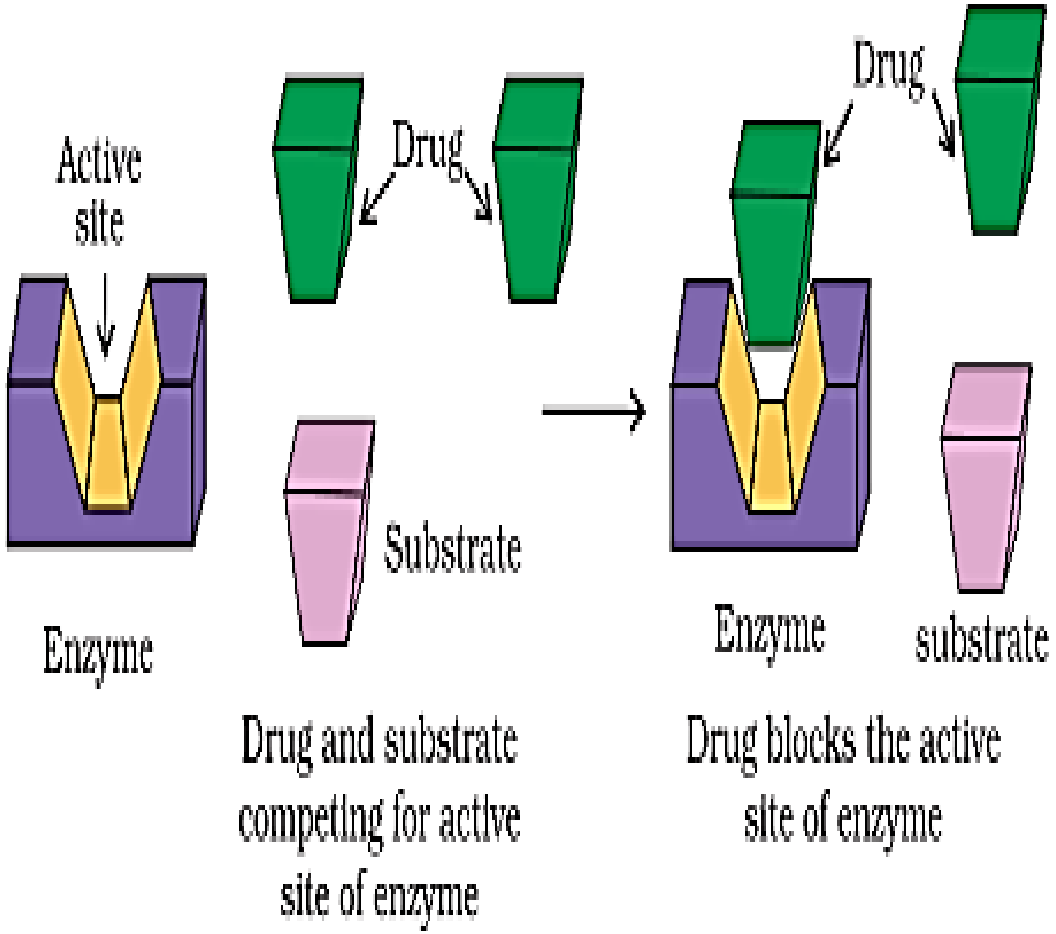
These can block the binding site of the enzyme and prevent the binding of substrate,

or can inhibit the catalytic activity of the enzyme. Such drugs are called enzyme inhibitors.

Drugs inhibit the attachment of substrate on active site of enzymes in two different ways;

- (i) Drugs compete with the natural substrate for their attachment on the active sites of enzymes. Such drugs are called competitive inhibitors

Fig. 16.2
Drug and substrate competing for active site



Inhibitors

- (ii) Some drugs do not bind to the enzyme's active site. These bind to a different site of enzyme which is called allosteric site.
- This binding of inhibitor at allosteric site changes the shape of the active site in such a way that substrate can-not recognize it.
- If the bond formed between an enzyme and an inhibitor is a strong covalent bond and cannot be broken easily, then the enzyme is blocked permanently

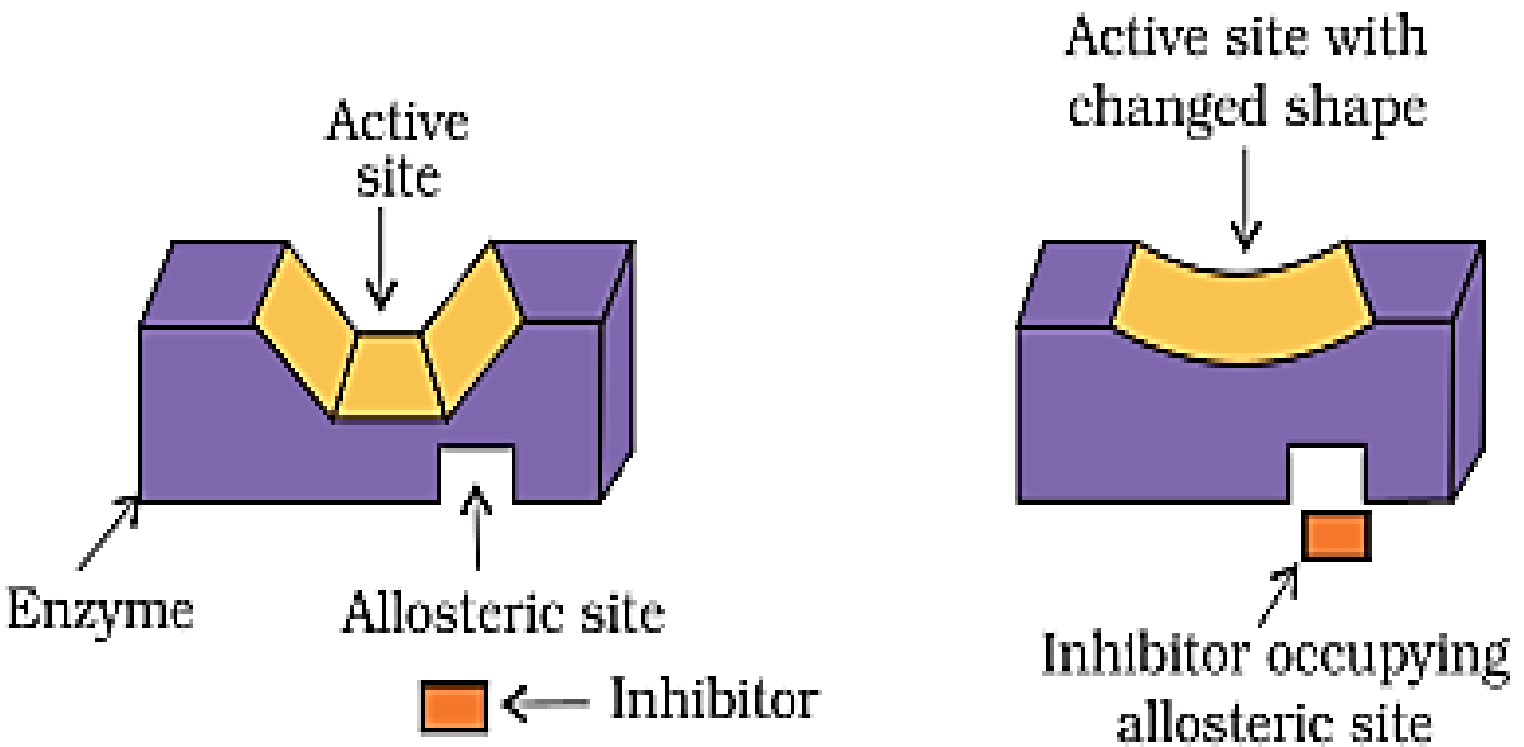


Fig. 16.3: Non-competitive inhibitor changes the active site of enzyme after binding at allosteric site.

Receptors as Drug Targets

- Receptors are proteins that are crucial to body's communication process.
- In the body, message between two neurons and that between neurons to muscles is communicated through certain chemicals.
- These chemicals, known as chemical messengers are received at the binding sites of receptor proteins.
- To accommodate a messenger, shape of the

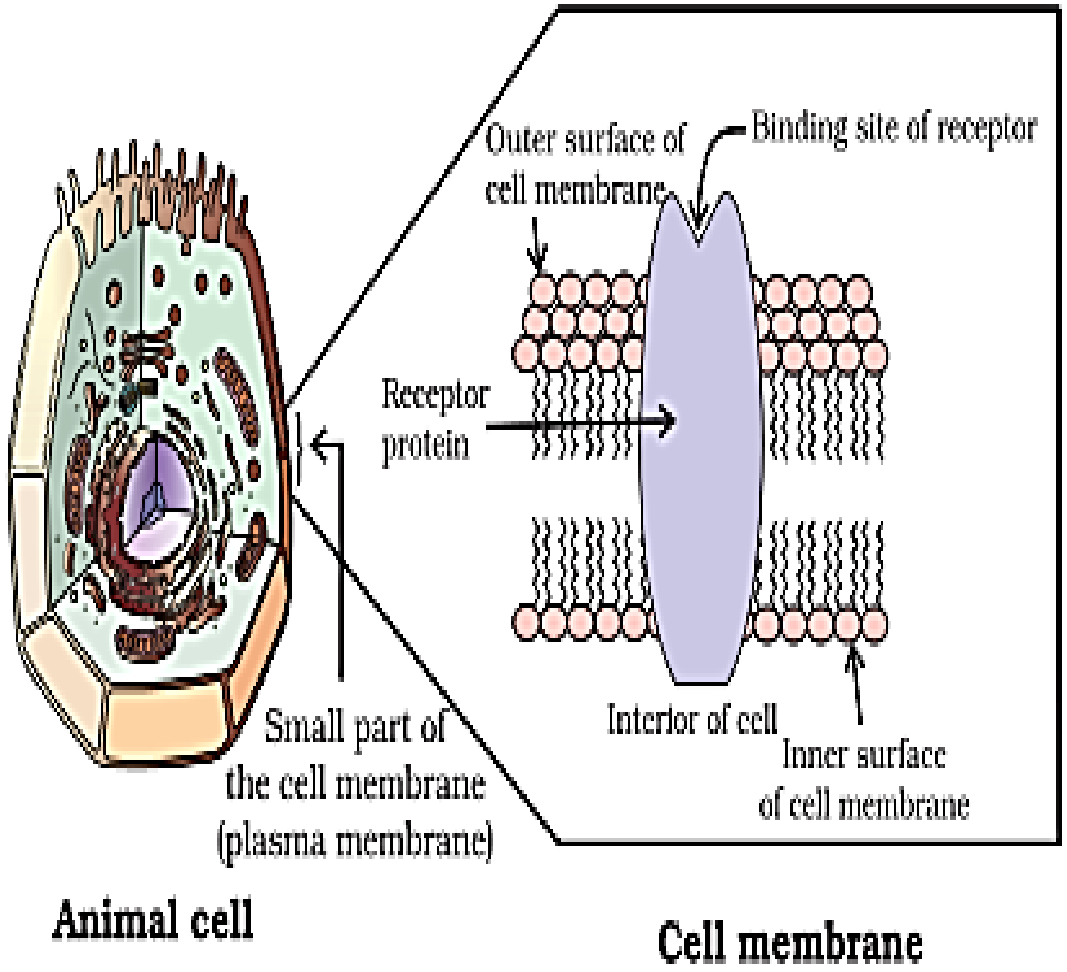


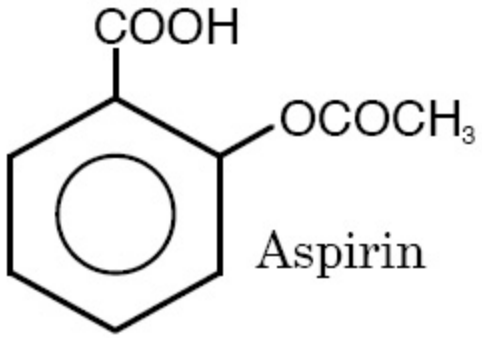
Fig. 16.4
Receptor protein embedded in the cell membrane, the active site of the receptor opens on the outside region of the cell.

Receptors as drug targets

Neurologically Active Drugs

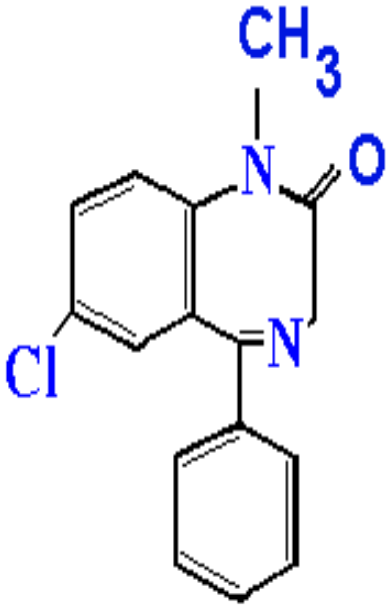
- Tranquilizers and analgesics are neurologically active drugs. These affect the message transfer mechanism from nerve to receptor.
- Tranquilizers are a class of chemical compounds used for the treatment of stress, and mild or even severe mental diseases. These relieve anxiety, stress, irritability or excitement by inducing a sense of well-being.

A. Analgesics

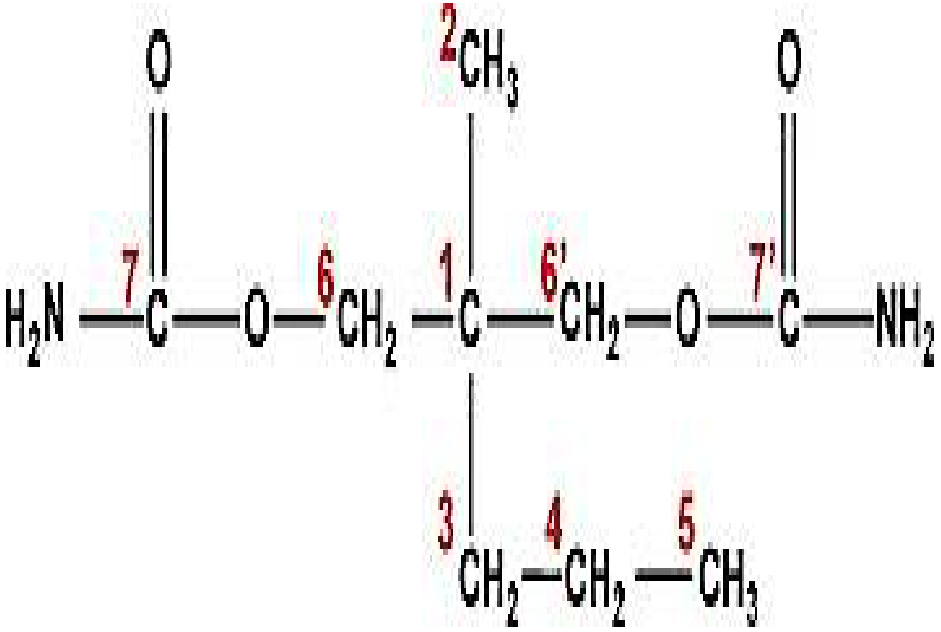
- Narcotic : morphine , codine, heroin
- Pain due to fracture, burns and post - operative
- Non – narcotic: aspirin
- 2 – acetoxy benzoic acid
- A 

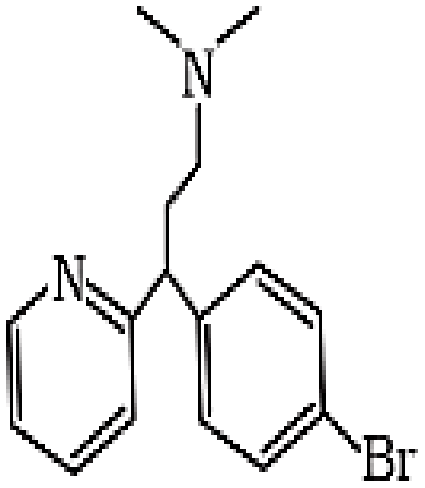
Aspirin
d

B. Tranquilizers

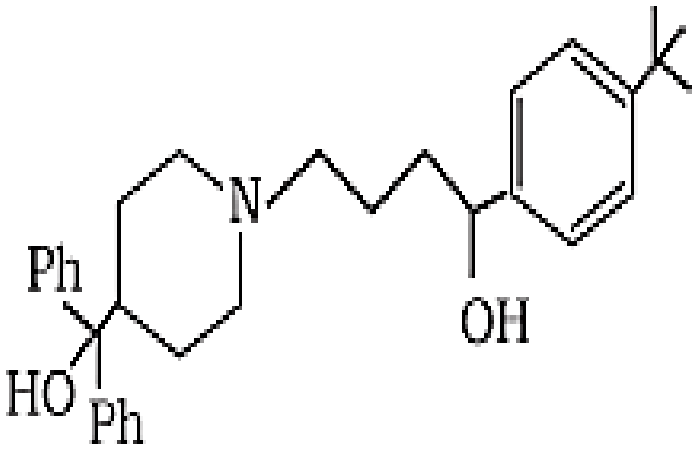


Diazepam
(Valium)





Brompheniramine
(Dimetapp, Dimetane)



Terfenadine (Seldane)

C. Antimicrobials

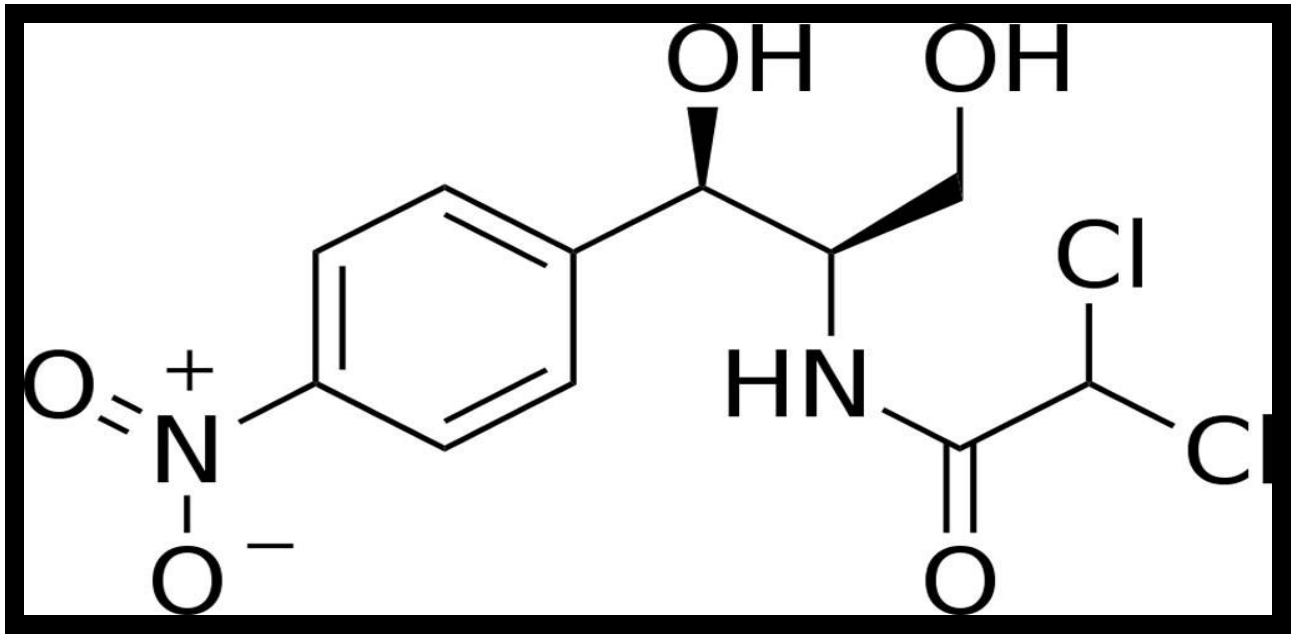
a) **Antibiotics :**Antibiotics are drugs used a to treat infections caused by micro organisms because of their low toxicity for humans and animals.

b) Initially antibiotics were classified as chemical substances produced by microorganisms (bacteria, fungi and molds) that inhibit the growth or even destroy microorganisms.

Antibiotics

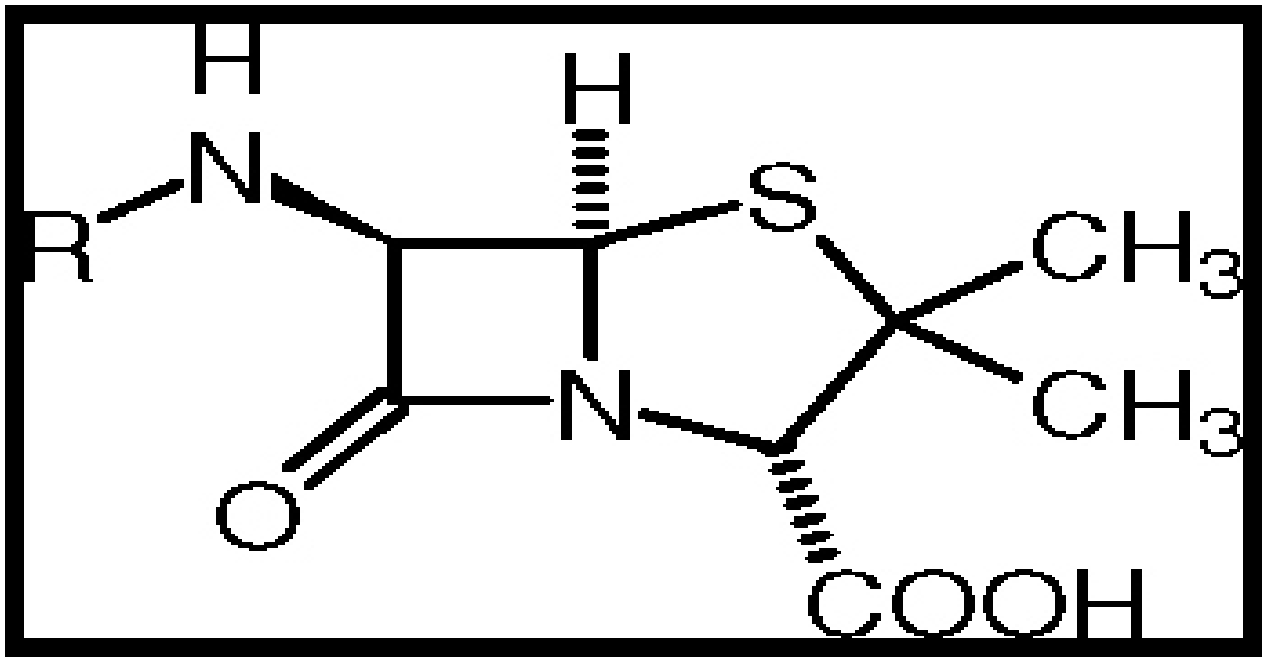
ANTIBIOTICS

- Broad spectrum: Chloramphenicol : effective on both gram +ve and gram – ve bacteria



Narrow spectrum

- Penicillin

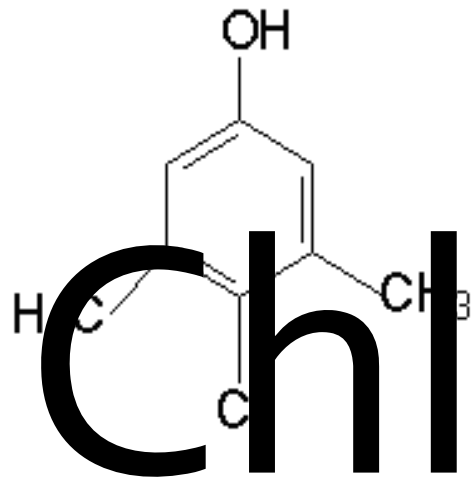


Antiseptics and disinfectants

- Antiseptics and disinfectants are also the chemicals which either kill or prevent the growth of microorganisms.
- Antiseptics are applied to the living tissues such as wounds, cuts, ulcers and diseased skin surfaces.
- Examples are furacine, soframicine, etc. These are not ingested like antibiotics.
- Commonly used antiseptic, dettol is a

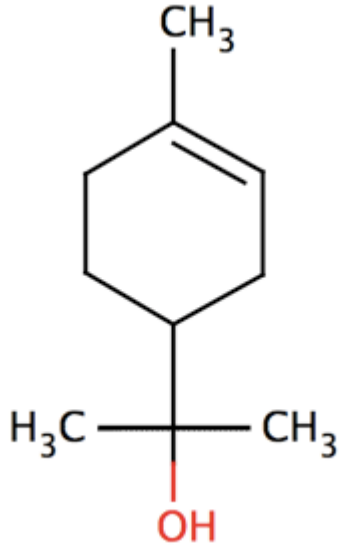
Constituents of Dettol

- Terpineol



- Chl

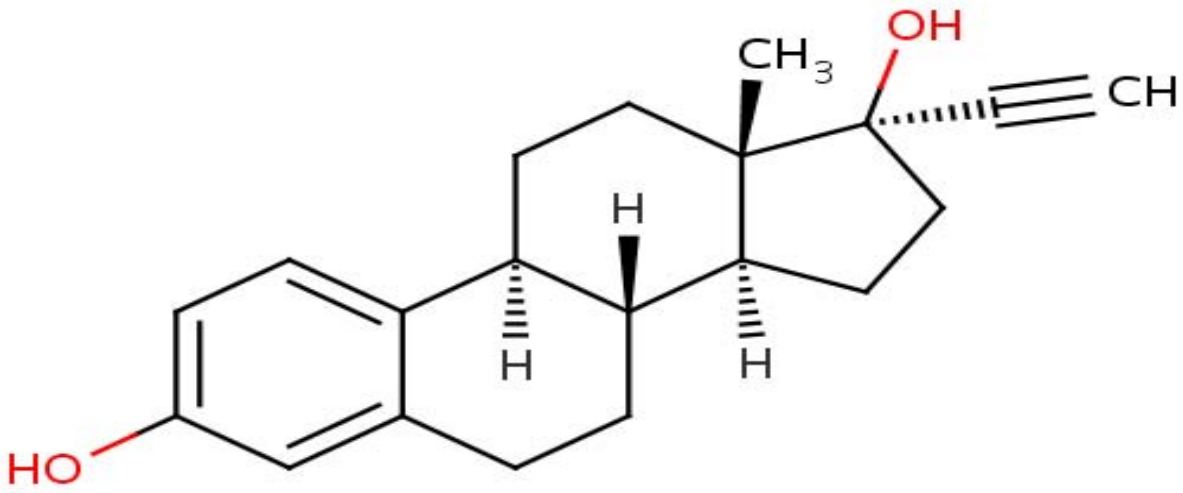
oroxy



D. Antifertility Drugs

- Antifertility drugs are the oral pills used for the birth control.
- These are generally steroids.
- These pills are mixture of synthetic estrogen and progesterone derivatives.
- These are more potent than natural hormones.
- Norethindrone is synthetic progesterone drug used as antifertility drug

Novestrol

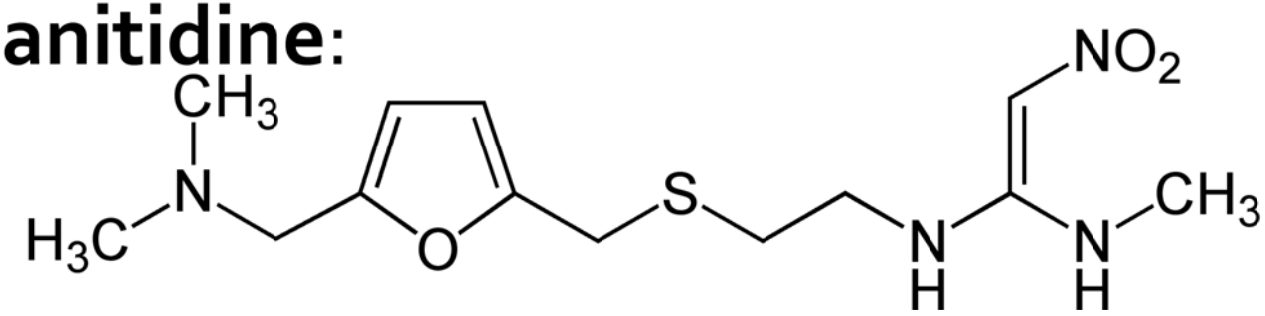


E. Antacids & Antihistamines.

Production of excess of acid in the stomach causes irritation and pain. In severe cases, ulcers are developed in the stomach.

- Basics substances that neutralize the excess of HCl in stomach are called antacids.

Eg. **Ranitidine**:



2. Antihistamines

Histamine is a potent vasodilator. It has various functions. It contracts the smooth muscles in the bronchi and gut and relaxes other muscles, such as those in the walls of fine blood vessels.

Histamine is also responsible for the nasal congestion associated with common cold and allergic response to pollen.

- Synthetic drugs, brompheniramine (Dimetapp) and terfenadine (Seldane), act as antihistamines.
- They interfere with the natural action of histamine by competing with histamine for binding sites of receptor where histamine exerts its effect.

Chemicals in Food

- Chemicals are added to food for
- (i) preservation,
- (ii) enhancing their appeal, and
- (iii) adding nutritive value in them.

Food preservation

- Preservative means a substance which when added to food is capable of inhibiting , retarding or arresting the process of fermentation , acidification or other decomposition of food by growth of microbes.

Physical methods

- 1. By removal of heat (cooling or refrigeration)
- 2.By addition of heat (pasteurization)
- 3.By removal of water (dehydration)
- 4.By irradiation (high energy electromagnetic radiation)

Chemical methods

- 1. Addition of sugar(jam , jellies etc)
- 2.Addition of salt (pickles)
- 3.Addition of vinegar (salad dressings)
- 4.Addition of other chemicals (sodium benzoate, salts of sorbic acid)

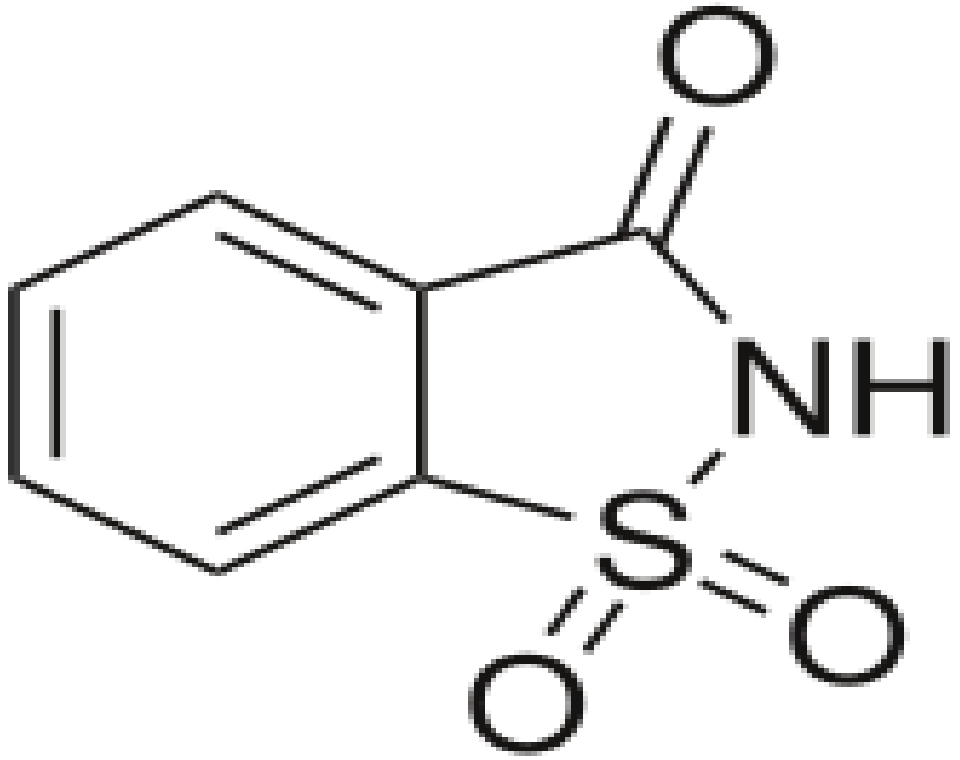
Food additives

- Main categories of food additives are as follows:
  (i) Food colours
  (ii) Flavours and sweeteners
  (iii) Fat emulsifiers and stabilising agents
  (iv) Flour improvers – antistaling agents and bleaches
  (v) Antioxidants
  (vi) Preservatives
  (vii) Nutritional supplements such as

ARTIFICIAL SWEETENERS :

- • The chemical substances which produce sweetness instead of natural sweeteners like sucrose are called artificial sweeteners.
- • These have great value in controlling calories and are used for diabetic persons.
- • The important artificial sweeteners are aspartame, saccharin, sucrolose & alitame etc.
- • Sucrolose is 600 times sweeter than

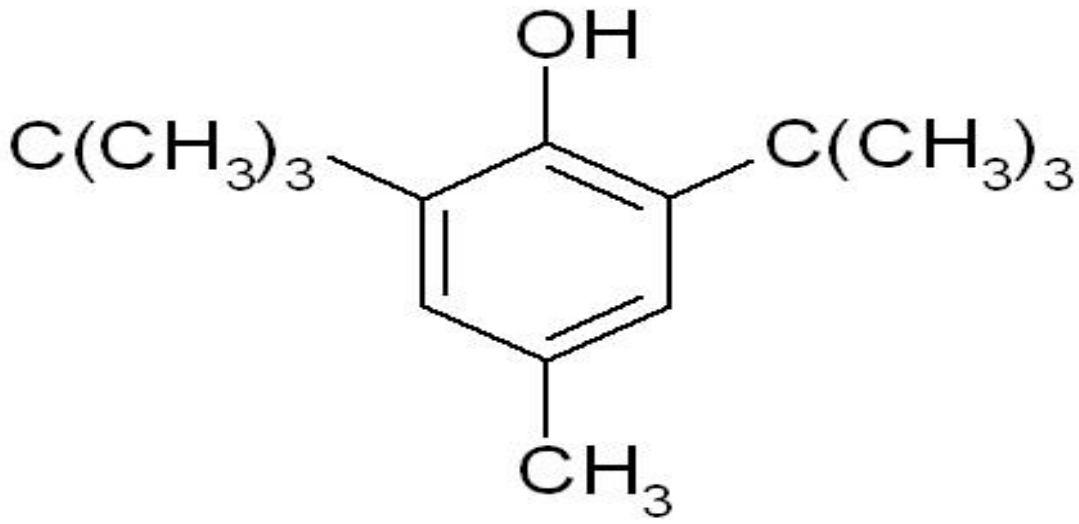
Saccharine $C_7H_5SNO_3$



Antioxidants

- An **antioxidant** is a substance when added to food , retards or prevents the oxidative deterioration of food.
- During oxidation of food , free radicals are generated.
- The antioxidant reacts with the free radicals and stops further oxidation.
- Examples : Butylated hydroxy toulene, butylated hydroxy anisole, sodium or

BHT



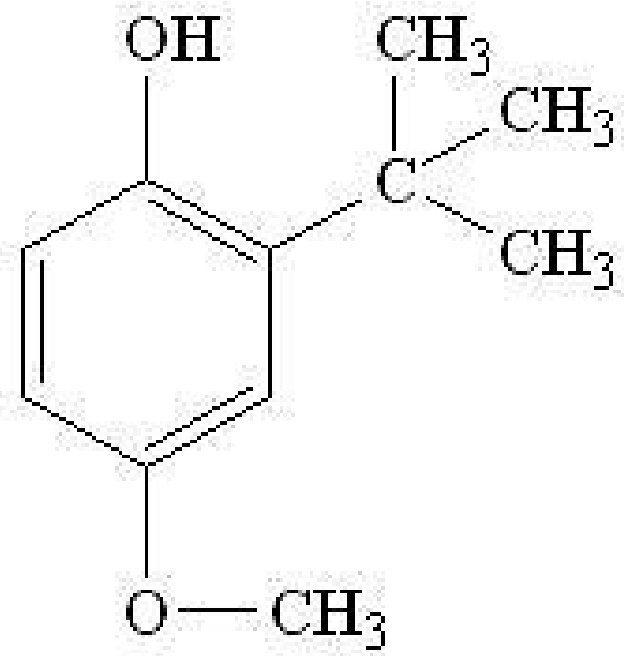
BHT（Butylated Hydroxytoluene）

C15H24O　220.35　CAS 128-37-0

White Crystalline Powder

FCCIV/ GB1900-80　99%

BHA Butylated Hydroxy Anisole



Butylated hydroxy anisole (BHA).

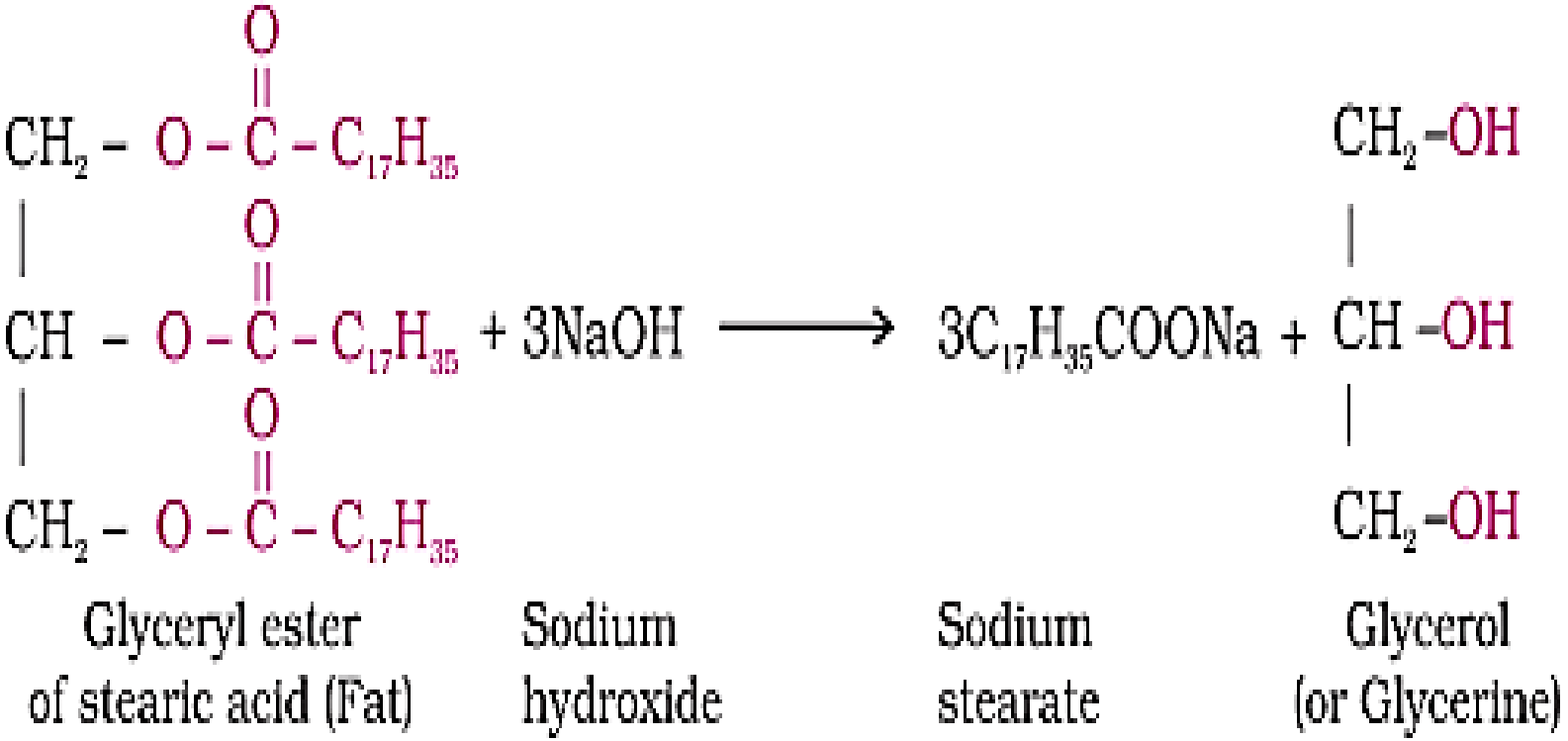
Cleansing Agents

- Two types of chemicals are used as cleansing agents.
- These are soaps and synthetic detergents.

- These improve cleansing properties of water.

- These help in removal of fats which bind other materials to the fabric or skin.
- Soaps are Na or K salts of higher fatty acids which contain more than 12 C atoms.

Soaps: hydrolysis of fats by



Neutralization of fatty acids

- Soaps are also prepared by direct action of NaOH or Na2CO3 on fatty acids.

- $RCOOH + NaOH \longrightarrow RCOONa + H_2O$

Detergents

- Synthetic detergents are cleaning agents with all properties of a soap but they contain no soap
- • Detergents can form lather extensively both with hard, soft and even ice cold water.
- These are Na salts of alkyl hydrogen sulphate or long chain alkyl benzene sulphonic acid.
- • Detergents are of three categories

1. Anionic detergents:

- Ex.: Sodium salts of sulphonated long chain alcohols or hydrocarbons like

- Sodium lauryl sulphate

- Sodium dodecyl benzene sulphonate

- The anionic part of the molecule is involved in

Cationic detergents:

- Ex: Quaternary ammonium salts of amines with acetates, chlorides or bromides.

  like

- n – hexadecyl trimethyl ammonium chloride or cetyl trimethyl ammonium chloride
- it is used in hair conditioners.
- The cationic part is involved in cleansing action.

Non-ionic detergents:

Ex.: Ester of stearic acid and polyethylene glycol

These are used in dish-washing.

Detergents cause water pollution by forming foams .

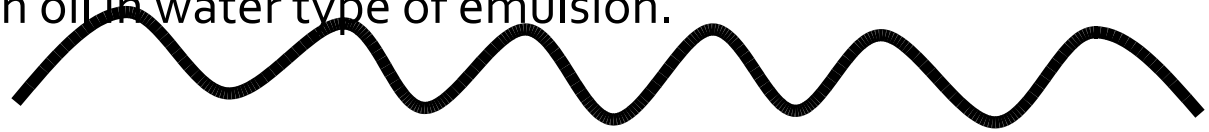
the branched long chain part of detergents

undergo biodegradation very slowly .

Straight chain type part biodegrades more easily and hence, are better

Mechanism of cleaning action

- A molecule of soap has two parts, a long chain of hydrocarbon tail soluble in oil and other part head soluble in water.
- When soap is added to oily part of a cloth or vessel the hydrocarbon part dissolves in oil keeping the head away.
- These on rubbing form small emulsified oil droplets that are washed away with water.
- The anions of emulsion repel each other and hence do not precipitate.
- It is an oil in water type of emulsion.



- H_3C COO^-Na^+